

FINAL SUBMISSION

EXECUTIVE SUMMARY

**ENERGY STUDIES OF
ARMY INDUSTRIAL FACILITIES
TOBYHANNA ARMY DEPOT
TOBYHANNA, PA**

CONTRACT NO. DACA65-88-C-0023

FOR

**U. S. ARMY CORPS OF ENGINEERS
NORFOLK, VIRGINIA**

PREPARED BY

UTILITY ENGINEERS DIVISION

QUAD THREE GROUP, INC.

37 NORTH WASHINGTON STREET

WILKES-BARRE, PENNSYLVANIA 18701

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DATE: OCTOBER 1990

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TABLE OF CONTENTS

VOLUME I

EXECUTIVE SUMMARY

	PAGE
Introduction	ES-1
Authorization	ES-2
Objectives of the Study	ES-2
Submission Requirements	ES-3
Installation Description	
A. Tobyhanna Army Depot	ES-4
B. Energy Consumption Summary	
C. Facility Utilization	
D. Included Facilities and Buildings	
The Audit	ES-6
Site Map	ES-7
Fuel Consumption and Costs Base Year 1987	ES-8
Coal	
Steam Production	
Electric	
Fuel Oil	
Diesel Fuel	
Unleaded Gasoline	
FY 87 Energy Usage Pie Chart	ES-15

FY 87 Energy Cost Pie Chart	ES-16	
Three Year Historical Energy Consumption and Cost Data	ES-17, 18	
Summary of Studied Energy Conservation Opportunities	ES-19	
Priority Listing and Narrative Descriptions	ES-40	
Project Funding	ES-56,57	
General Maintenance Comments	I-1	TAB 1
Transformer Capacity	I-2	
Summary Energy Conservation Opportunities	II-1	TAB 2
Disposition of Energy Conservation Opportunities as Listed in SOW Annex A	II-22	
Improve Facility Layout and Space Utilization	III-1	TAB 3
Energy Monitoring and Control System	IV-1	TAB 4
Building Descriptions		
Building 1A	V-1	TAB 5
Building 1B	V-57	
Building 1C	V-92	
Building ASRS	V-126	
Building 2	V-144	
Building 3	V-174	
Building 4	V-203	
Building 5	V-246	
Building 6	V-286	

TABLE OF CONTENTS

VOLUME II

	PAGE
Building Descriptions (continued)	
Building 7	V-317
Building 8	V-346
Building 9	V-376
Building 10	V-414
Building 11	V-446
Building 12	V-467
Building 13	V-495
Building 14	V-514
Building 15	V-541
Building 16	V-573
Building 18	V-597
Building 19	V-619
Building 20	V-642
Building 21	V-657
Building 22	V-680
Building 23	V-707
Building 24	V-734
Building 41	V-760
Building 42	V-784
Building 43	V-805
Building 45	V-828

TABLE OF CONTENTS

VOLUME II

	PAGE	
Building Descriptions (continued)		
Building 55	V-837	
Buildings 86, 87, 88, 97 & 98	V-853	
Building 93	V-865	
Building 94	V-877	
Building 99	V-888	
Building 103	V-900	
Building 230	V-904	
Building 233	V-908	
Building 241	V-912	
Building 247	V-928	
Building 1024	V-940	
Previous Energy Analysis	VI-1	TAB 6
Sample Form 1391 and	VII-1	TAB7
Sample Project Development Brochure		

TABLE OF CONTENTS

VOLUME III

Appendix A	TAB 8
Summary Energy Use and Energy Cost	
Existing Energy Consumption	
Existing Electrical Actual Monthly Bills	
Typical Summer and Winter Demand Graphs	
Typical Cost Analysis	
Energy Conversion Factors	TAB 9
Fuel Cost Conversions	TAB 10
"U" Values	
Sample Calculations	
Glossary of Acronyms	
Scope of Work	TAB 11
Entrance Interviews	
Appendix B	TAB 12
Sample Computer Input Data	
Sample Computer Output Data	TAB 13
Computer Output Energy Consumption Summary Sheets	TAB 14

TABLE OF CONTENTS

Project Development Brochures and Documentation for Productivity Capital Investment Programs

Projects Qualifying for Funding TAB 15

Form 5108	Cargo Door Strip Curtains Priority No. 1 - QRIP
Form 5108	Heat Recovery at Plating Rinse Water Priority No. 3 - QRIP
Form 5108	Ventilation Heat Reclaim at Large Exhaust Systems Priority No. 4 - OSD-PIF
Form 5108	Energy Monitoring and Control System Priority No. 8 - OSD-PIF
Form 5020	Removal of Existing Incandescent Fixtures Priority No. 10 - ECIP
Form 5020	New Combustion Controls - Building 22 Priority No. 17 - ECIP

INTRODUCTION

The final submittal of this report, prepared upon completion of all work required by this contract, is hereby presented for review. The submittal includes a description of each of the buildings studied showing building age, construction, HVAC equipment, lighting, power, process, maintenance listings, energy management system listings, and energy conservation opportunity listings.

Energy and cost savings are presented for ECO's by computer generated monthly energy load data. Life cycle cost analyses for energy conservation options are also performed by computer computation.

Summaries and recommendations are presented for each building with supporting data as detailed above.

AUTHORIZATION

Energy surveys of Army Industrial Facilities at Tobyhanna Army Depot, Tobyhanna, Pennsylvania, were authorized by the Department of the Army, Corps of Engineers, Norfolk District, Norfolk, Virginia under Contract No. DACA65-88-C-0023 with a Notice to Proceed dated February 24, 1988.

OBJECTIVES OF THE STUDY

The objectives of the study are as follows:

- a. Perform a complete energy audit and analysis of the industrial facility.
- b. Identify all energy conservation opportunities including low cost/no cost ECO's and perform complete evaluation of each.
- c. Prepare programming and implementation documentation for all justifiable energy conservation opportunities.
- d. List and prioritize all recommended energy conservation opportunities.
- e. Prepare a comprehensive report which documents the work accomplished, the results, and recommendations.

SUBMISSION REQUIREMENTS

The study is divided into three submissions:

Interim submittal.

Pre-final submittal.

Final submittal.

ARMY INDUSTRIAL FACILITY - TOBYHANNA

INSTALLATION DESCRIPTION

A. Tobyhanna Army Depot (TOAD) is located 21 miles southeast of Scranton, Pennsylvania, along Interstate Route 380. The depot's mission consists primarily of maintenance and supply functions. The depot is situated on a 1,293 acre site, which includes a 398 acre secure area for the industrial complex. The depot has 114 buildings, not including family housing, which total over 3-1/2 million square feet (SF). Approximately 24 percent of this space is occupied by maintenance operations and 56 percent is occupied by supply operations. The total building area of the depot, including housing, is approximately 3,741,000 SF. There are 42 residential units on post, housing a population of approximately 150. The depot work-force, both Government and Contractor, consists of 50 to 60 military and approximately 4,176 civilian personnel.

The primary mission of the Maintenance Directorate is to repair, fabricate, modify, and/or assemble ground and airborne navigational, surveillance and satellite communications-electronics systems and supporting components. The Maintenance Directorate also performs testing of generator sets and repair and painting of military vehicles.

The mission of the Supply Directorate is the receipt, storage, care and preservation, and shipment of general supplies, motor vehicles, generator sets, communications-electronics equipment and supporting components.

B. Energy Consumption Summary

Ninety-eight percent of TOAD'S energy is consumed by facilities for industrial operations. The remaining consumption is for mobility operations. In FY 87, the depot consumed a total of 605,516 MBtu's of energy.

C. Facility Utilization

The facility generally operates from 7:30 a.m. to 5:00 p.m. with manufacturing personnel arriving for a 7:30 a.m. to 4:00 p.m. shift and office occupancy occurring between the hours of 8:00 a.m. and 5:00 p.m. Limited overtime hours occur in bottleneck areas of Buildings 1A, 1B, 1C, 4, 9, 14 and various other areas. Overtime is required at times by individual project deadlines.

D. Included Facilities and Buildings (See attached Site Plan ES-7)

Buildings which were surveyed and audited are as follows: 1A, 1B, 1C, 2, 3, 4, 5, 6, 7, 8, 9, 10A, 10B, 10C, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 41, 42, 43, 45, 55, 86, 87, 88, 93, 94, 97, 98, 99, 103, 230, 233, 241, 247, 1024, and ASRS.

E. Note

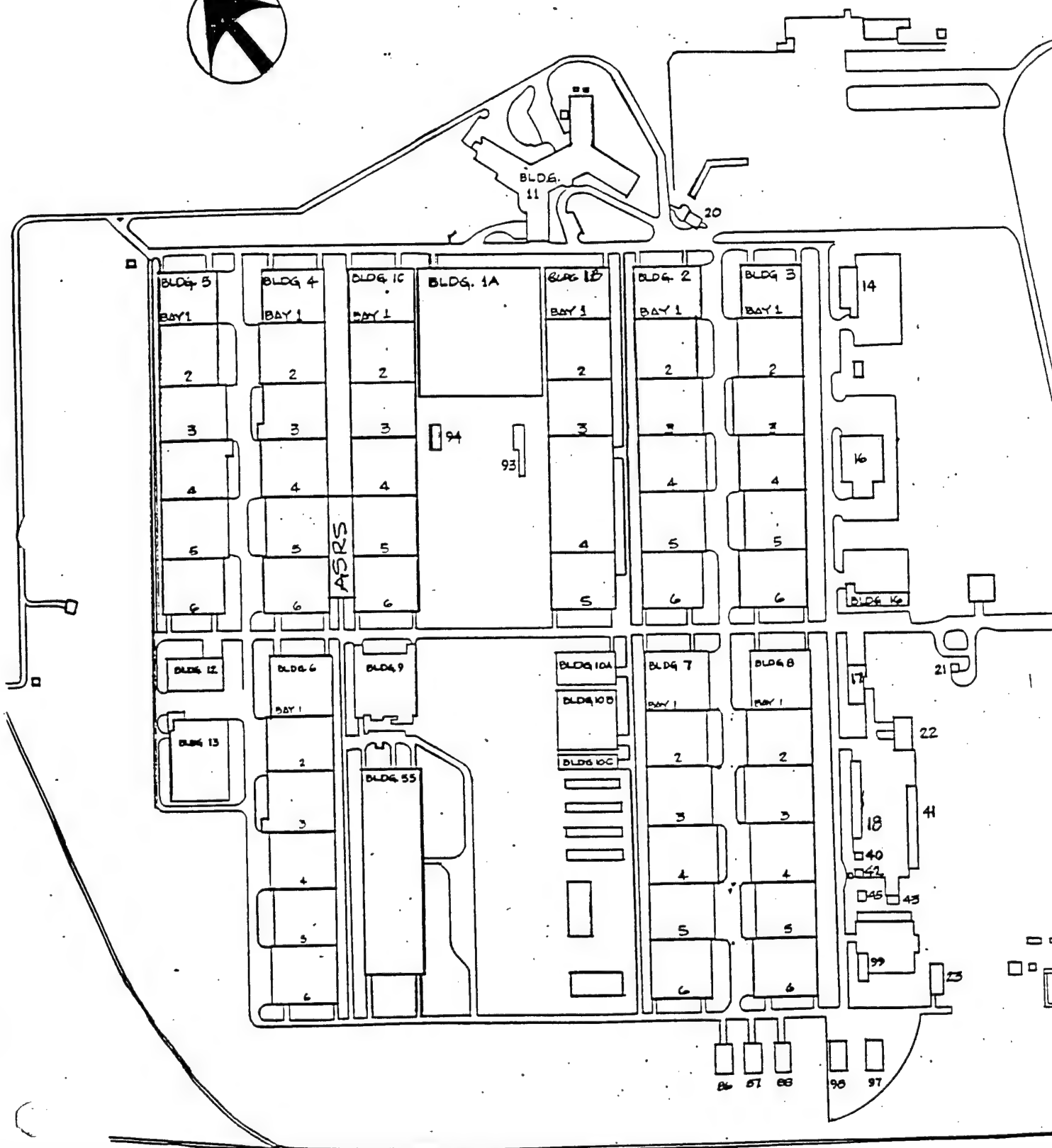
Appendix A and Appendix B (attached) contain all supporting data and calculations from which ECO recommendations have been made.

THE AUDIT

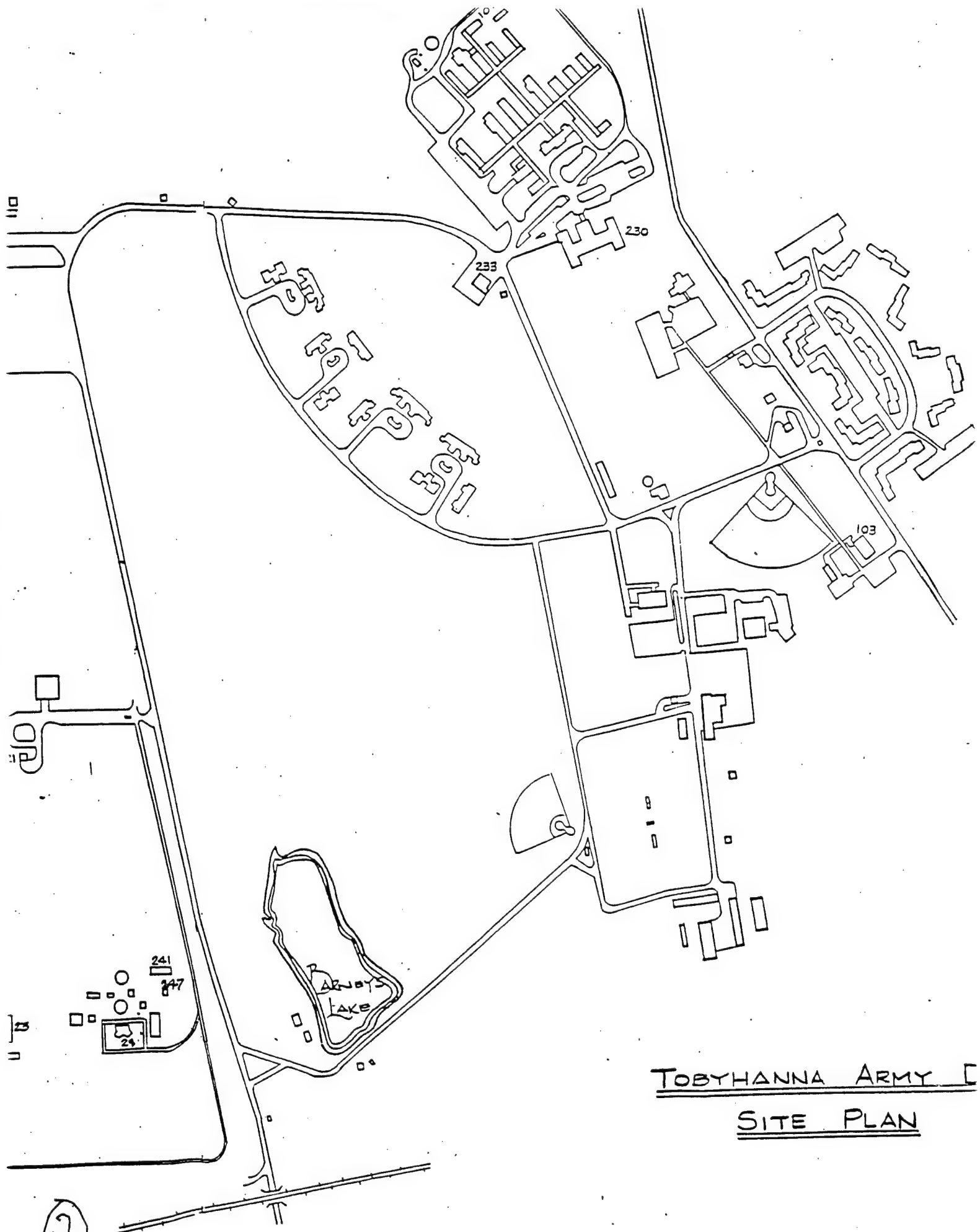
The initial site survey was conducted from June 6, 1988 through September, 1988. Information on building construction, systems, usage, operation, etc., was gathered through collection of drawings, review of equipment layouts, visual inspection, and discussions with base personnel. The survey was accomplished on a building-by-building basis, supervised by Raymond Balcerzak, P.E., Mechanical Engineer and Project Manager; assisted by Dale Englehart, Electrical Engineer, and Daniel Fritz, Architectural Representative. The survey task was undertaken by the above personnel in order to obtain the full range of data required for this report. Survey notes were taken on data gathering forms specifically created for this project and included in appendices hereto.

Collected data was assembled and collated for later use in preparing calculations, completion evaluations, and making recommendations for conservation of energy.

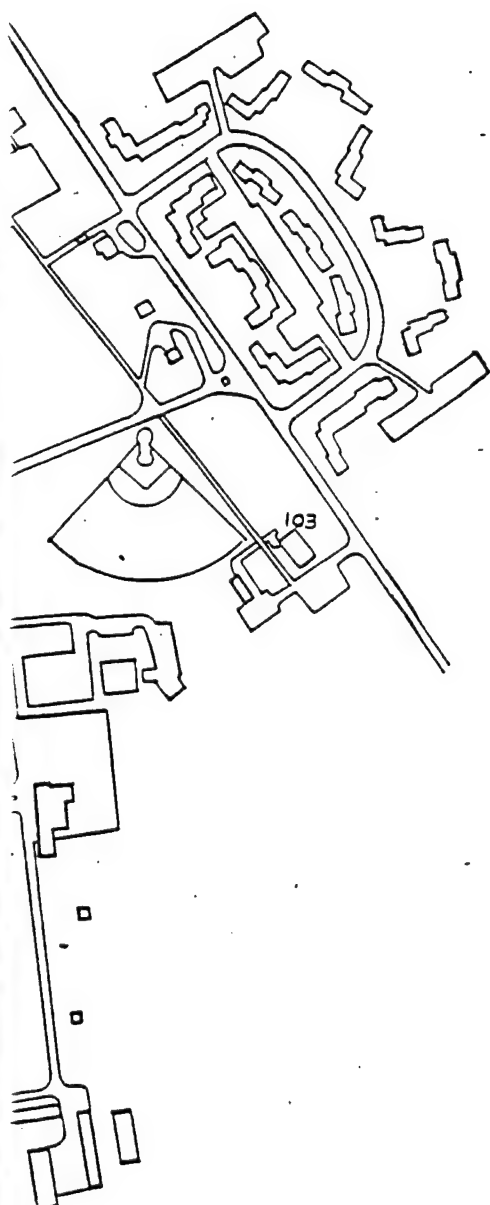
The audit was completed, for the most part, on each building separately, although in a few circumstances base-wide evaluations were made. Such instances are clearly indicated in the report.



1



TOBYHANNA ARMY []
SITE PLAN



BYHAMNA ARMY DEPOT
SITE PLAN

3

**FUEL CONSUMPTION
AND COSTS**

BASE YEAR 1987

FUEL CONSUMPTION

Using FY-87 as the base year for fuel consumption, the enclosed charts and graphs show monthly and annual consumption and cost of coal, electricity, diesel fuel, unleaded gasoline and fuel oil. A separate chart is included for coal consumption and cost at Building 22, the major central steam plant at TOAD.

Fuel costs reflect projected costs using actual FY-87 consumption and FY-87 fuel cost rates. Electricity costs reflect projected costs using actual FY-87 consumption and the filed tariff of the serving utility company (PP&L) for FY-87.

The FY-89 rates are used herein for calculations as directed by the Norfolk District COE and the agency, TOAD.

COAL - FY-87

Nominal Heat Content: 25.4 MBtu/ton

Coal Costs: Barley - \$58.43/ton FY-87
Rice - \$72.25/ton FY-87

MONTH	CONSUMPTION (TONS)				COST (\$)	
	BLDG 22	BLDG 230	BLDG 103	BLDG 1024	MONTHLY	CUMULATIVE
FY-87						
Oct. '86	1359	26	0	0	81285	81285
Nov.	2172	43	12	46	134311	215596
Dec.	2672	70	8	92	168614	384210
Jan. '87	2795	45	20	71	173298	557508
Feb.	2612	58	13	90	164454	721962
Mar.	2423	54	10	66	151117	873078
Apr.	1865	21	5	17	112117	985195
May	692	49	2	17	45385	1030580
Jun.	148	24	0	0	10382	1040962
Jul.	167	12	6	0	11058	1052020
Aug.	192	52	0	17	14976	1066996
Sep.	189	20	0	45	15740	1082736
TOTALS	17286	474	76	461		

BUILDING 22 - STEAM PRODUCTION

MONTH	STEAM PRODUCTION	MAKE-UP WATER	HEATING DEG. DAYS	
			MONTHLY	CUMULATIVE
FY-87	X (1000 LBS)	(GALLONS)		
Oct. '86	25164	606500	464	464
Nov.	40438	741500	896	1360
Dec.	49837	984800	1123	2483
Jan. '87	52223	989600	1333	3816
Feb.	48680	1054000	1294	5110
Mar.	45181	992500	997	6107
Apr.	34761	847000	548	6655
May	12485	401700	326	6981
Jun.	2220	153500	82	7063
Jul.	2486	333000	20 est.	7083
Aug.	2676	142100	45	7128
Sep.	2816	198900	140	7268
TOTALS	318967	7445100		

ELECTRICITY - FY-87

Energy Conversion: 3.413 MBtu/Mwh

Cost: \$.0594/KWH

MONTH	CONSUMPTION (MWH)		COST (\$)	
	MONTHLY	CUMULATIVE	MONTHLY	CUMULATIVE
FY-87				
Oct. '86	2294	2294	142104	142104
Nov.	2201	4495	137335	279439
Dec.	2292	6787	142253	421682
Jan. '87	2281	9068	140791	562473
Feb.	2314	11382	143556	706029
Mar.	2399	13781	146725	852754
Apr.	2462	16243	147981	1000735
May	2185	18428	137102	1137837
Jun.	2351	20779	144588	1282425
Jul.	2458	23237	152371	1434796
Aug.	2774	26011	137536	1572332
Sep.	2456	28467	151831	1724163

FUEL OIL - FY-87

Nominal Heat Content: 5.825 MBtu/BBL = 0.1387 MBtu/gal Cost: \$.75/gal - 5.41/MBtu

MONTH	CONSUMPTION (BBL)		TOTAL (BBL)	COST (\$)	
	BUILDINGS	FAMILY HOUSING		MONTHLY	CUMULATIVE
FY-87					
Oct. '86	243	75	318	10019	10019
Nov.	327	81	408	12860	22879
Dec.	558	144	702	22122	45001
Jan. '87	497	126	623	19633	64634
Feb.	513	263	776	24442	89076
Mar.	603	102	705	22219	111295
Apr.	194	47	241	7596	118891
May	63	0	63	1985	120876
Jun.	80	0	80	2521	123397
Jul.	0	0	0	0	123397
Aug.	68	117	185	5832	129229
Sep.	49	0	49	1536	130765
TOTALS	3195	955	4150		

DIESEL FUEL - FY-87

Nominal Heat Content: 5.825 MBtu/BBL = 0.1387 MBtu/gal Cost: \$.75/gal = \$5.41/MBtu

MONTH	CONSUMPTION (BBL)						COST (\$)	
	MOBILITY	RESERVES	OTHER	BLDG.	PROCESS	LOSS	(BBL)	MONTHLY CUMULATIVE
FY-87								
Oct. '86	41	9	32	3	49	1	135	4254
Nov.	44	14	1	0	43	0	102	3214
Dec.	53	8	1	3	38	0	103	3246
Jan. '87	95	10	1	4	24	0	134	4223
Feb.	73	4	5	3	27	0	112	3530
Mar.	49	11	2	0	48	0	110	3467
Apr.	53	9	1	0	70	1	134	4223
May	43	10	3	0	46	1	103	3246
Jun.	44	18	92	0	53	1	208	6555
Jul.	43	35	4	0	51	1	133	4191
Aug.	48	12	33	0	35	0	128	4034
Sep.	40	4	1	0	47	0	92	2899
TOTALS	626	144	176	13	531	5	1495	

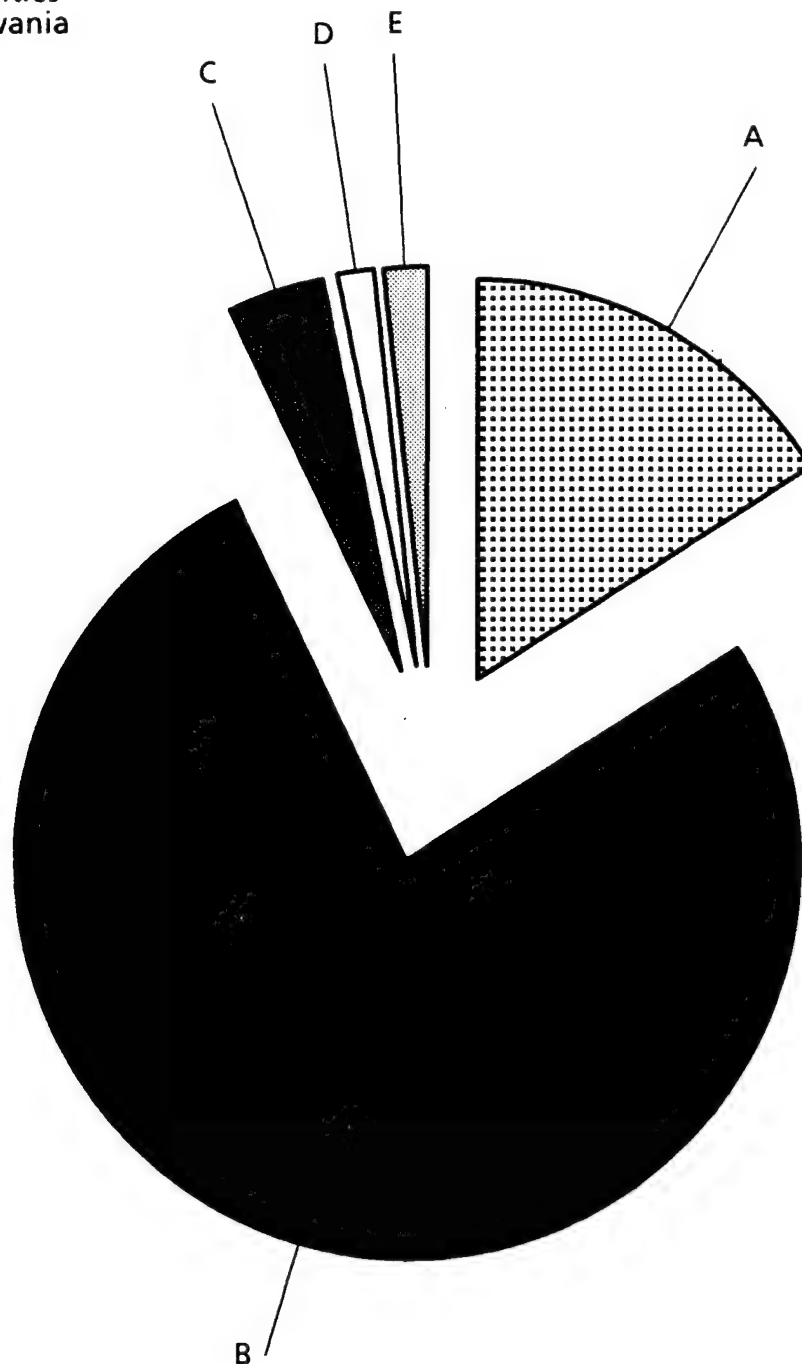
UNLEADED GASOLINE - FY-87

Nominal Heat Content: 5.25 MBtu/BBL = 0.125 MBtu/gal Cost: \$6.88/MBtu

MONTH	CONSUMPTION (BBL)					CONSUMPTION (BBL)	COST (\$)	
	MOBILITY	RESERVES	PROCESS	OTHER	LOSS		MONTHLY	CUMULATIVE
FY-87								
Oct. '86	101	3	65	0	2	171	6502	6502
Nov.	99	5	45	1	2	152	5671	12173
Dec.	116	1	52	2	4	175	6502	18675
Jan. '87	119	4	52	1	3	179	6899	25574
Feb.	118	4	58	1	4	185	6863	32437
Mar.	109	2	59	2	5	177	6574	39011
Apr.	108	3	61	1	6	179	6682	45693
May	107	3	53	0	3	166	6393	52086
Jun.	96	5	62	5	1	169	6610	58696
Jul.	96	2	56	1	0	155	5924	64620
Aug.	94	1	68	1	1	165	6321	70941
Sep.	98	1	67	1	5	172	6393	77334
TOTALS	1261	34	698	16	36	2045		

TOBYHANNA ARMY DEPOT

Army Industrial Facilities
Tobyhanna, Pennsylvania



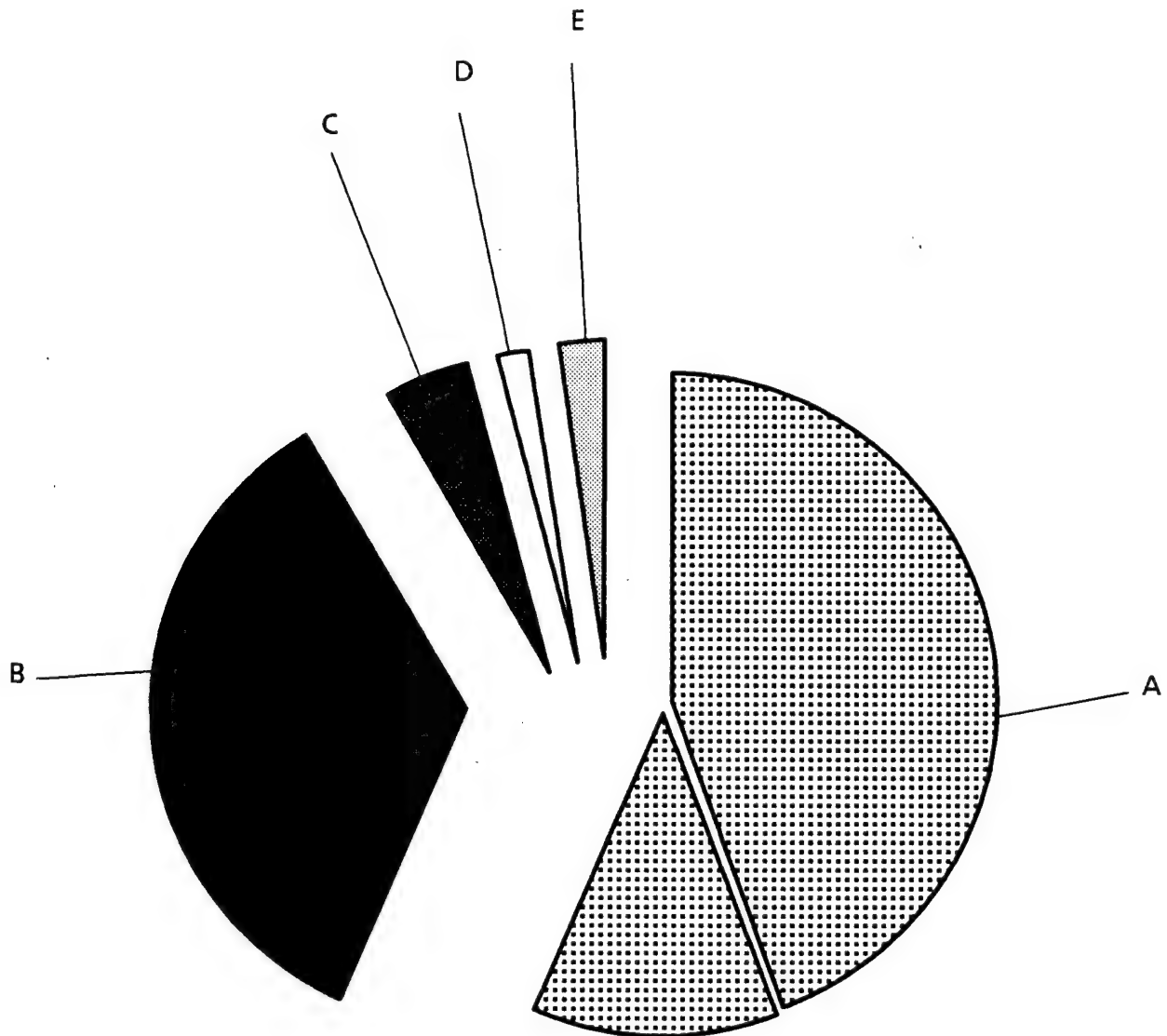
ENERGY USAGE FY 1987

A	Electricity	97,158	MBTU	16.1%
B	Coal (steam)	464,743	MBTU	76.8%
C	Fuel Oil	24,171	MBTU	4.0%
D	Diesel Fuel	8,708	MBTU	1.4%
E	Unleaded Gasoline	10,736	MBTU	1.7%

TOTAL ENERGY USAGE	605,516	MBTU
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TOBYHANNA ARMY DEPOT

Army Industrial Facilities
Tobyhanna, Pennsylvania



ENERGY COST FY 1987

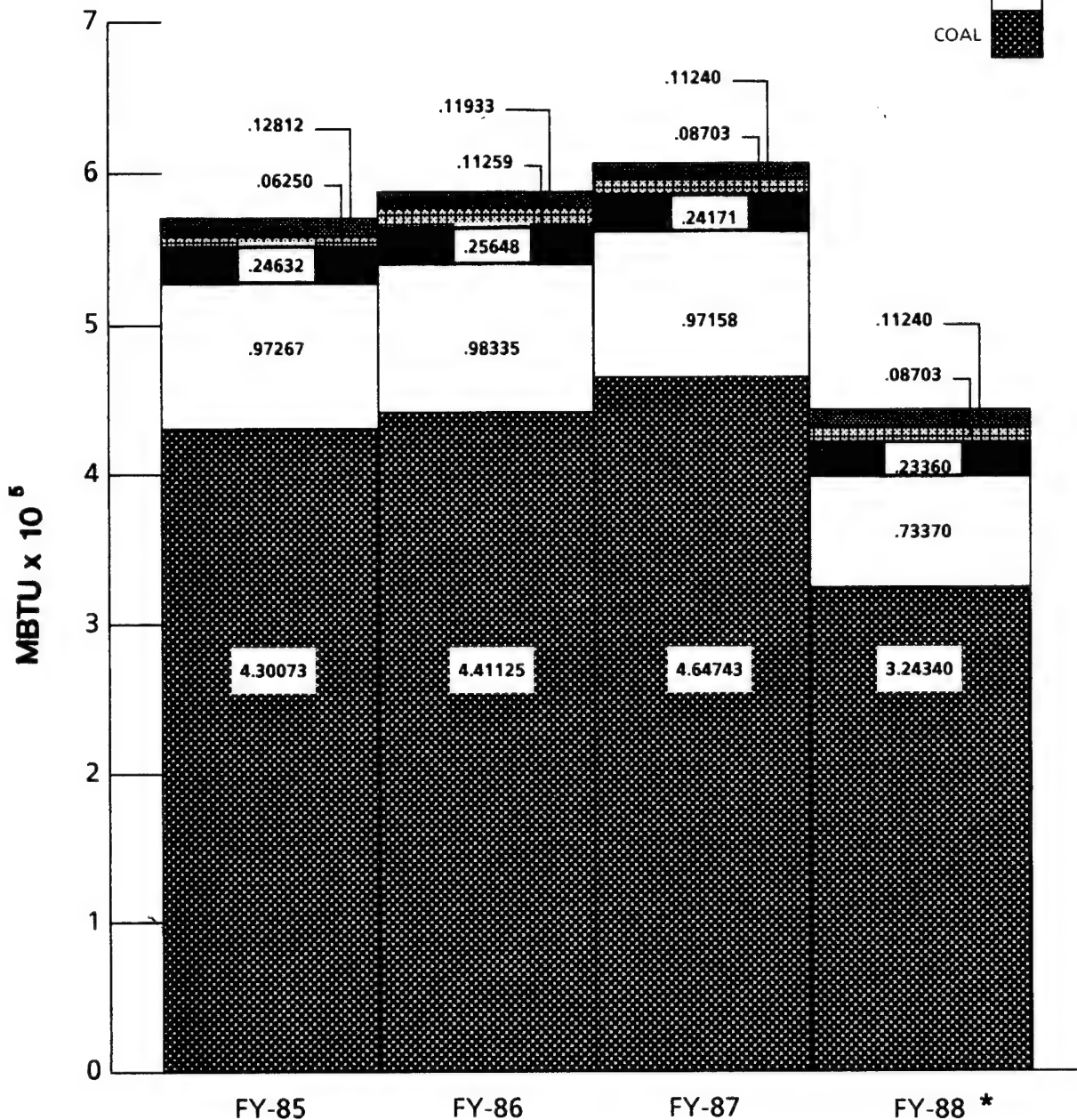
A	Electricity (usage)	\$1,360,365	44.5%
	Electricity (demand)	\$363,798	11.9%
B	Coal (steam)	\$1,082,736	35.4%
C	Fuel Oil	\$130,765	4.3%
D	Diesel Fuel	\$47,082	1.5%
E	Unleaded Gasoline	\$73,865	2.4%

TOTAL ENERGY COST	\$3,058,611
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**THREE YEAR
HISTORICAL ENERGY CONSUMPTION
AND COST DATA**

TOBYHANNA ARMY DEPOT
 Army Industrial Facilities
 Tobyhanna, Pennsylvania

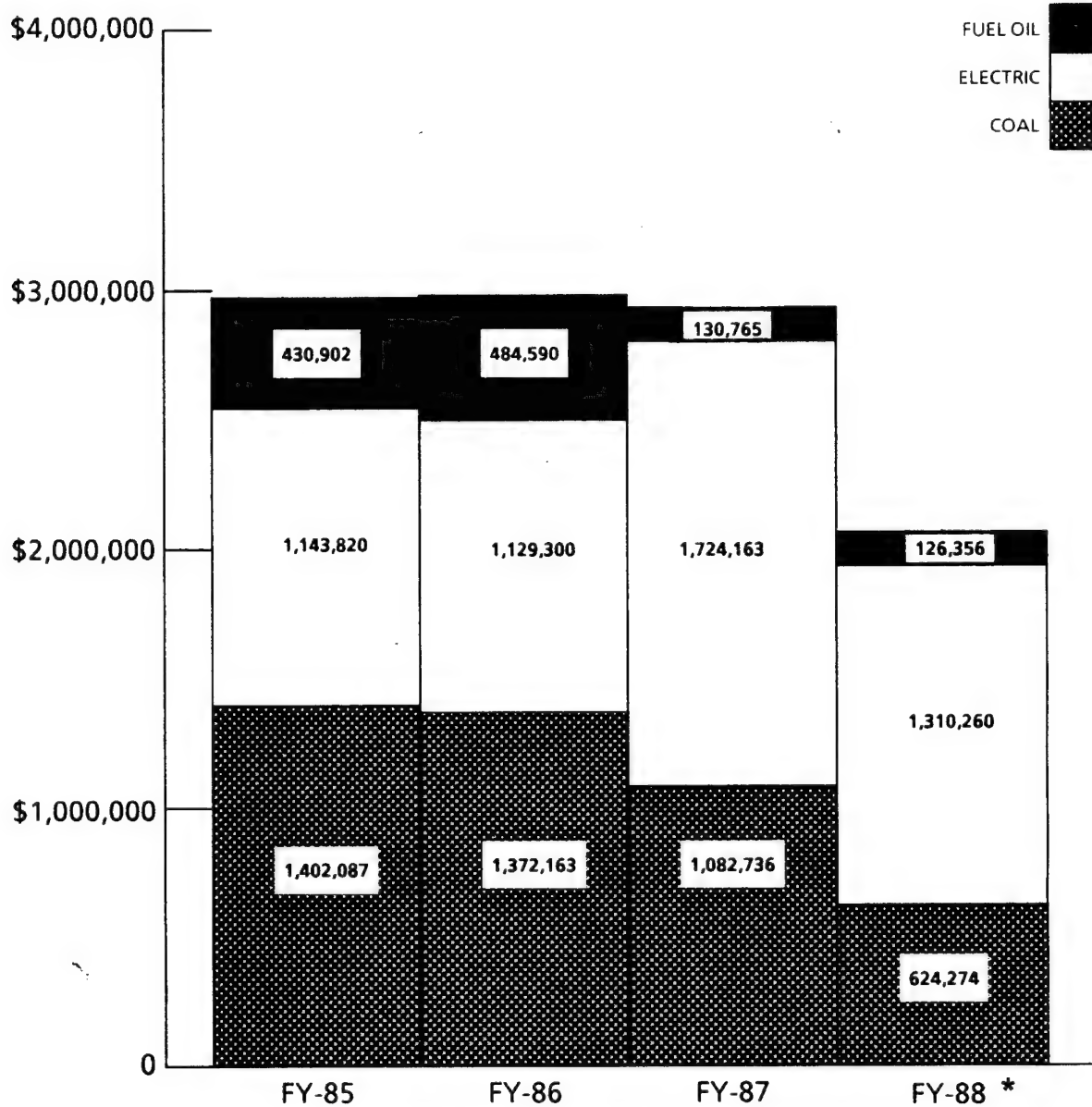
UNLEADED GASOLINE
 DIESEL FUEL
 FUEL OIL
 ELECTRIC
 COAL



ANNUAL ENERGY CONSUMPTION
 (MBtu × 10⁵)

* ENERGY CONSUMPTION FOR FY-88 IF ALL PROPOSED ECO'S ARE COMPLETED

TOBYHANNA ARMY DEPOT
 Army Industrial Facilities
 Tobyhanna, Pennsylvania



**ANNUAL ENERGY COSTS
 (DOLLARS)**

* ENERGY COSTS FOR FY-88 IF ALL PROPOSED ECO'S ARE COMPLETED

COSTS VS ENERGY

FY	ENERGY SOURCE	\$/MBTU
85	Coal	3.26
	Electric	11.76
	Fuel Oil	17.50
	Diesel Fuel	Not Available
	Unleaded Gasoline	Not Available
86	Coal	3.11
	Electric	11.48
	Fuel Oil	18.90
	Diesel Fuel	Not Available
	Unleaded Gasoline	Not Available
87	Coal	2.33
	Electric	17.75
	Fuel Oil	5.41
	Diesel Fuel	Not Available
	Unleaded Gasoline	Not Available
89	Coal	3.27
	Electric	17.40
	Fuel Oil	5.41
	Diesel Fuel	5.41
	Unleaded Gasoline	6.88

ES-18A

**SUMMARY OF STUDIED ENERGY
CONSERVATION OPPORTUNITIES (ECO'S)**

SUMMARY OF STUDIED ENERGY CONSERVATION OPPORTUNITIES (ECO'S)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Estimated Annual Savings (Energy)				Total Investment (\$)	Disposition
				Electricity MBTU	Steam MBTU	Cost Savings (\$)			
1-1A	Repair or replace weatherstripping	6.84	1.70	3.6	509	2,351		2,875	Recommended
2-1A	Replace incandescent lighting	0.73	14.12	115.7	---	2,014		40,152	Not Recommended
3-1A	Ventilation heat reclaim at large exhaust systems	5.37	2.10	---	39,589	129,365		279,443	Recommended
4-1A	Replacement of all single glazed windows	0.29	39.8	---	450	1,471		60,180	Not Recommended
5-1A	Heat recovery at plating rinse water	8.27	1.39	---	4,924	16,089		22,982	Recommended
6-1A	"Goldplating" and scrap reduction	---	---	---	---	---		---	NA
7-1A	Radiant heating	---	---	---	---	---		---	NA
8-1A	Production equipment replacements, modifications and disposals	---	---	---	---	---		---	NA

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
9-1A	Energy efficient motors and variable frequency drives (25 HP)	0.83	12.57	7.85	---	136.62	1,762	Not Recommended
10-1A	Scheduling and loading of production equipment	---	---	---	---	---	---	NA
11-1A	Facility layout and space utilization	---	---	---	---	---	---	NA
12-1A	Consolidation of processes and equipment requiring special environments (computers)	---	---	---	---	---	---	NA
13-1A	Production equipment maintenance	---	---	---	---	---	---	NA
14-1A	Energy efficient ballasts	.41	25.66	0.24	---	4	106	Not Recommended
15-1A	Energy management and control systems	2.21	3.79	---	See Section IV	---	---	Recommended
16-1A	Air compressor heat recovery system	2.63	4.4	---	719	2,349	10,568	Recommended
17-1A	Removal of existing fluorescent fixtures	9.12	1.14	0.71	---	12.0	15	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-1B	Weatherstripping	1.88	6.0	---	346	1,131	6,979	Recommended
2-1B	Additional insulation for roof at Bays No. 2 through 5	.38	30.3	1.0	3,029	9,906	307,800	Not Recommended
3-1B	Replacement of existing incandescent lighting	1.91	5.43	859	---	14,950	106,195	Recommended
4-1B	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
5-1B	Exterior insulation for walls	.50	22.8	---	2,102	6,868	160,785	Not Recommended
6-1B	Radiant heating	---	---	---	---	---	---	NA
7-1B	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
8-1B	Elimination of roof skylights	.25	45.4	---	602	1,967	91,600	Not Recommended
9-1B	Cargo door strip curtain	30.5	.38	---	1,656	5,411	2,092	Recommended

1-1C	Weatherstripping	1.46	7.9	---	341.1	1,115	9,004	Recommended
2-1C	Exterior insulation for walls	.25	46	---	1,201	3,925	185,347	Not Recommended
3-1C	Additional insulation for roof		32.8	---	3,316	10,836	364,829	Not Recommended
4-1C	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
5-1C	Replacement of all single glazed windows	.30	51.4	.06	517	1,692	89,205	Not Recommended
6-1C	Cargo door strips	30.56	.38	---	3,312	10,821	4,186	Recommended
7-1C	Production equipment maintenance	---	---	---	---	---	---	NA
8-1C	Radiant heating	---	---	---	---	---	---	NA
9-1C	Energy efficient ballasts	.41	25.0	.24	---	4.14	106	Not Recommended
10-1C	"Goldplating" and scrap reduction	---	---	---	---	---	---	NA
11-1C	Consolidate processes and equipment requiring special environments	---	---	---	---	---	---	NA
12-1C	Energy efficient motors	.84	12.65	11.2	---	194	2,454	Not Recommended
<hr/>								
1-ASRS	Removal of existing electrical and provision of a replacement steam heating coils	3.21	3.08	150	- 250	1,788	5,643	Recommended
2-ASRS	Compressed air system intake	.95	11	2	---	40	451	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-2	Repair and/or replace weather-stripping	2.76	4.17	---	572	1,870	8,004	Recommended
2-2	Exterior insulation for walls	.26	46.2	19	2,253	7,687	348,840	Not Recommended
3-2	Additional insulation for roof	.36	33.6	39	3,357	11,647	378,594	Not Recommended
4-2	Replacement of existing incandescent lighting	1.92	5.42	2,575	---	44,825	318,048	Recommended
5-2	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
6-2	Radiant heating	---	---	---	---	---	---	NA
7-2	Cargo door strips	21.83	.53	---	1,656	5,410	2,929	Recommended
8-2	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

1-3	Repair and/or replace weather-stripping	1.15	10.0	---	208	680	6,997	Recommended
2-3	Exterior insulation for walls	.25	50.0	33	2,084	7,391	348,840	Not Recommended
3-3	Additional insulation for roof	.37	33.6	61	3,354	12,015	378,594	Not Recommended
4-3	Replacement of existing incandescent lighting	1.92	5.42	2,575	---	44,825	318,048	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	See Section IV	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
5-3	Energy management and monitoring	2.21	3.79	---	---	---	---	---	Recommended
6-3	Radiant heating	---	---	---	---	---	---	---	NA
7-3	Cargo door strips	21.83	.53	---	---	1,656	5,410	2,929	Recommended
8-3	Energy efficient ballasts	.41	25.6	.24	---	---	4.14	106	Not Recommended

1-4	Repair and/or replace weather-stripping	11.14	1.03	---	---	2,080	6,798	7,214	Recommended
2-4	Addition of exterior insulation for walls	.27	43.2	1.4	---	2,108	6,912	305,235	Not Recommended
3-4	Addition of insulation for roof	.58	20	2.0	---	5,549	18,162	369,360	Not Recommended
4-4	Replacement of existing incandescent lighting	1.72	6.04	1,116	---	---	19,442	159,294	Recommended
5-4	Addition of heat destratification fans for Bays #5 and #6	1.50	7.8	.75	---	379	1,250	9,850	Recommended
6-4	Energy management and monitoring	2.21	3.79	---	---	---	---	---	Recommended
7-4	Cargo door strips	25.46	.45	---	---	1,656	5,410	2,512	Recommended
8-4	Energy efficient ballasts	.41	25.6	.24	---	---	4.14	106	Not Recommended
9-4	Compressed air system	.71	14.5	2	---	---	40	595	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
10-4	Production equipment maintenance	---	---	---	---	---	---	NA
11-4	Radiant heating	---	---	---	---	---	---	NA
12-4	Energy efficient motors and variable frequency drives	.83	12.65	11.2	---	194	2,045	Not Recommended
1-5	Weatherstripping	6.14	1.9	---	429	1,403	2,701	Recommended
2-5	Exterior insulation for walls	.41	49.1	58	3,398	12,122	348,840	Not Recommended
3-5	Additional insulation for roof	.23	32.4	21	2,120	7,291	369,360	Not Recommended
4-5	Replacement of existing incandescent lighting fixtures	1.95	5.32	1,716	---	22,887	212,393	Recommended
5-5	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
6-5	Cargo door strips	21.82	.53	---	828	2,205	1,465	Recommended
7-5	Energy efficient motors and variable frequency drives	.83	12.65	11.1	---	194	2,454	Not Recommended
8-5	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
9-5	Radiant heating	---	---	---	---	---	---	NA
10-5	Replace overhead door	1.01	11.4	---	107	350	4,104	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-6	Weatherstripping	2.76	4.2	---	572	1,871	8,009	Recommended
2-6	Exterior insulation for walls	.28	43.0	26	2,419	8,357	348,840	Not Recommended
3-6	Additional insulation for roof	.38	32.8	55	3,357	11,925	369,360	Not Recommended
4-6	Replacement of existing incandescent lighting fixtures	1.91	5.42	2,575	---	44,825	318,588	Recommended
5-6	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
6-6	Cargo door strips	26.19	.44	---	1,656	5,410	2,442	Recommended
7-6	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
8-6	Radiant heating	---	---	---	---	---	---	NA
1-7	Weatherstripping	3.86	2.9	---	580	1,897	5,809	Recommended
2-7	Exterior insulation for walls	.26	46.7	24	2,225	7,696	348,840	Not Recommended
3-7	Additional insulation for roof	.38	32.8	59	3,357	11,992	369,360	Not Recommended
4-7	Replacement of existing incandescent lighting fixtures	1.91	5.42	429	---	7,471	53,098	Recommended
5-7	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
6-7	Cargo door strips	21.83	.53	---	1,656	5,410	2,929	Recommended
7-7	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
8-7	Radiant heating	---	---	---	---	---	---	NA
1-8	Weatherstripping	3.34	3.5	---	572	1,871	6,619	Recommended
2-8	Exterior insulation for walls	.28	43.1	26	2,413	8,332	348,840	Not Recommended
3-8	Additional insulation for roof	.38	32.8	55	3,357	11,926	369,360	Not Recommended
4-8	Replacement of existing incandescent lighting fixtures	1.91	5.42	2,575	---	44,825	318,588	Recommended
5-8	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
6-8	Cargo door strips	21.83	.53	---	1,656	5,410	2,929	Recommended
7-8	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
8-8	Radiant heating	---	---	---	---	---	---	NA
1-9	Replacement of existing single glazed windows	.20	57.1	---	71	232	13,594	Not Recommended
2-9	Heat recovery system for the steam clean area	1.67	6.53	-3	497	1,577	11,183	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
3-9	Heat recovery for the main air compressors	1.77	6.5	---	968	3,162	21,136	Recommended
4-9	Cargo door strips	21.82	.53	---	2,483	8,115	4,396	Recommended
5-9	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
6-9	Radiant heating	---	---	---	---	---	---	NA
7-9	Production equipment replacements, modifications and disposals	---	---	---	---	---	---	NA
8-9	Production equipment maintenance	---	---	---	---	---	---	NA
9-9	Improved methods of control to reduce rework	---	---	---	---	---	---	NA
10-9	Heat recovery from generator testing	---	---	---	---	---	---	NA
11-9	Energy management and control system	2.21	3.79	---	---	See Section IV	---	Recommended
12-9	Energy efficient motors and variable frequency drives	.54	19.44	16	---	281	5,465	Not Recommended

10A, 10B & 10C								
1-10	Weatherstripping	.73	15.7	---	112	366	5,902	Not Recommended
2-10	Exterior insulation for walls	.07	169	---	525	1,717	297,705	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
3-10	Replacements of single glazed windows	.35	32.5	---	421	1,377	45,936	Not Recommended
4-10	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
5-10	Cargo door strips	3.49	3.3	---	927	3,031	10,256	Recommended
6-10	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
7-10	Radiant heating	---	---	---	---	---	---	NA
8-10	Production equipment maintenance	---	---	---	---	---	---	NA
9-10	Improve compressor efficiency	.78	13.3	1.9	---	33	451	Not Recommended
10-10	Heat recovery from generator testing	---	---	---	---	---	---	NA

1-11	Repair and/or replacement of weatherstripping	1.16	9.9	---	37	121	1,231	Recommended
2-11	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
3-11	Cargo door strip curtains	1.54	7.5	---	28	91	697	Recommended
4-11	Energy efficient ballasts	.41	25	.24	---	4.14	106	Not Recommended
5-11	Energy efficient motors and variable frequency drives	.83	12.58	7.85	---	136.62	1,718	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-12	Weatherstripping	1.17	9.9	---	78	255	2,589	Recommended
2-12	Exterior insulation for uninsulated walls	.41	28.3	---	415	1,355	39,240	Not Recommended
3-12	Energy management and monitoring	2.21	3.79	---	See Section IV	---	---	Recommended
4-12	Replacement of single glazed windows	.17	69	---	45	147	10,244	Not Recommended
5-12	Cargo door strips	2.75	4.2	---	224	731	3,140	Recommended
6-12	Energy efficient ballasts	.41	25	.24	---	4.14	106	Not Recommended
7-12	Energy efficient motors and variable frequency drives	.83	12.58	7.8	---	136	1,718	Not Recommended

1-13	Replacement of the automatic air lock doors which allow trucks to travel into the warehouse building	.44	25.0	20	81	605	15,390	Not Recommended
2-13	Replacement of single glazed windows	.37	31.3	---	122	399	12,804	Not Recommended
3-13	Energy efficient motors and variable frequency drives	.83	12.58	7.8	---	136	1,718	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-14	Repair and/or replacement of weatherstripping	.85	13.5	---	45	147	2,041	Not Recommended
2-14	Insulation of the walls	.35	33.7	---	316	1,033	34,627	Not Recommended
3-14	Additional insulation for roof	.32	36.1	---	127	416	15,390	Not Recommended
4-14	Energy management and control system	2.21	3.79	See Section IV	---	---	---	Recommended
5-14	Cargo door strips	3.06	3.76	---	232	757	2,930	Recommended
6-14	Air compressor heat recovery system	.99	10.5	3.74	---	65	697	Not Recommended
7-14	Radiant heating	---	---	---	---	---	---	NA
1-15	Additional insulation for walls	.34	34.4	---	133	435	15,349	Not Recommended
2-15	Additional insulation for roof	.25	44.9	3.9	240	851	39,304	Not Recommended
3-15	Replacement of single glazed windows	.17	79.4	6.7	212	809	56,446	Not Recommended
4-15	Replacement of uninsulated overhead doors	.79	14.1	7.2	92	424	6,156	Not Recommended
5-15	Energy management and control system	2.21	3.79	See Section IV	---	---	---	Recommended
6-15	Radiant heating	---	---	---	---	---	---	NA

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
7-15	Electrical distribution	---	---	---	---	---	---	NA
8-15	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
9-15	Replacement of fluorescent fixtures	---	---	---	---	---	---	NA

1-16	Repair and/or replacement of weatherstripping	.58	19.8	---	25	82	1,665	Not Recommended
2-16	Replacement of all single glazed windows	.18	62.8	.22	104	343	21,928	Not Recommended
3-16	Additional insulation for roof	.29	40.4	.12	111	362	15,033	Not Recommended
4-16	Energy management and control system	2.21	3.79	See Section IV				Recommended
5-16	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
6-16	Replacement of fluorescent fixtures	---	---	---	---	---	---	NA

1-18	Repair and/or replacement of weatherstripping	.97	11.8	---	35	115	1,396	Recommended
2-18	Additional insulation for roof	.60	25.0	9.9	158	690	13,232	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
3-18	Replacement of dust collection systems to recirculate air during heating season	1.35	8.5	---	106	347	3,035	Recommended
4-18	Replacement of glazing in carpentry shop	.28	52.4	3.56	66	278	11,605	Not Recommended
5-18	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
6-18	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
1-19	Repair and/or replacement of weatherstripping	.71	16.02	---	17	55	923	Not Recommended
2-19	Replacement of all single glazed windows	.16	72.9	.06	36	119	8,804	Not Recommended
3-19	Additional insulation for roof	.35	33.8	.12	67	222	7,603	Not Recommended
4-19	Additional insulation for walls	.21	53.5	---	149	488	26,759	Not Recommended
5-19	Energy management and control systems	2.21	3.79	---	See Section IV	---	---	Recommended
6-19	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-20	Repair and/or replacement of weatherstripping	.50	22.9	---	12	39	923	Not Recommended
2-20	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
3-20	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

1-21	Weatherstripping	1.19	11.5	---	12	65	769	Recommended
2-21	Exterior insulation of the walls	.75	18.4	---	105	568	10,711	Not Recommended
3-21	Insulation of the roof system	.77	17.8	---	14	76	1,391	Not Recommended
4-21	Replacement of all uninsulated glazing	.54	26	---	41	222	5,789	Not Recommended
5-21	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
6-21	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

1-22	Energy efficient motors and variable frequency drives	.83	14.39	7.8	---	596	4,789	Not Recommended
2-22	New combustion controls	1.31	9.0	---	11,397	37,267	343,710	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
3-22	New economizers	.89	16.3	---	11,405	37,627	492,480	Not Recommended
1-23	Exterior insulation for walls	.16	81.5	4.54	173	645	47,304	Not Recommended
2-23	Replacement of existing incandescent lighting	1.97	6.74	80.2	---	1,396	9,657	Recommended
3-23	Elimination of existing ventilating penthouse	.23	49.4	---	51	167	8,449	Not Recommended
4-23	Replacement of existing uninsulated glazing	.29	56.2	1.4	15	73	2,828	Not Recommended
5-23	Replacement of existing rolling steel doors	.16	70.1	---	48	157	11,286	Not Recommended
6-23	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
7-23	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
1-24	Repair and/or replacement of weatherstripping	.58	23.8	---	12	66	1,587	Not Recommended
2-24	Additional insulation for roof	1.41	10.5	3.04	99	589	5,748	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
3-24	Replacement of all single glazed windows	.48	29.9	.57	41	232	6,802	Not Recommended
4-24	Replacement of the heating boiler	1.96	7.0	---	368	1,991	14,364	Recommended
5-24	Replacement of the digester boiler	---	---	---	---	---	---	NA
6-24	Energy management and control system	2.21	3.74	---	See Section IV	---	---	Recommended
7-24	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

1-41	Repair and/or replacement of weatherstripping	.67	17.2	---	30	98	1,733	Not Recommended
2-41	Exterior insulation on walls	.32	35.6	.17	341	1,116	40,717	Not Recommended
3-41	Replacement of single glazed windows	.17	66.3	---	15	48	3,334	Not Recommended
4-41	Replacement of rolling steel door	.20	52.2	---	14	46	2,520	Not Recommended
5-41	Energy management and control system	2.21	3.74	---	See Section IV	---	---	Recommended
6-41	Cargo door strips	1.74	6.6	---	157	513	3,488	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-42	Repair and/or replacement of weatherstripping	.38	30	---	5	16	504	Not Recommended
2-42	Exterior insulation for walls	.29	40.3	.06	53	175	7,171	Not Recommended
3-42	Additional insulation for roof	.17	71.7	.06	4	14	962	Not Recommended
4-42	Replacement of existing single glazed windows	.16	79.5	---	8	27	2,135	Not Recommended
5-42	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended

1-43	Repair and/or replacement of weatherstripping	.74	15.6	---	9	29	472	Not Recommended
2-43	Exterior insulation for walls	.18	65.3	---	45	147	9,855	Not Recommended
3-43	Additional insulation for roof	.29	38.5	---	16	51	2,068	Not Recommended
4-43	Replacement of existing uninsulated glazing	.21	54.7	---	8	26	1,467	Not Recommended
5-43	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
6-43	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-55	Cargo door strips	4.03	2.86	---	828	2,706	7,936	Recommended
2-55	Radiant heating	---	---	---	---	---	---	NA
3-55	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
4-55	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended

86, 87, 88, 97 & 98								
1	Replacement of existing lighting fixtures	---	---	---	---	---	---	NA
2	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended

1-93	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
2-93	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended

1-94	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
2-94	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended

Estimated Annual Savings (Energy)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs.)	Electricity MBTU	Steam MBTU	Cost Savings (\$)	Total Investment (\$)	Disposition
1-99	Addition of insulation for walls and roof	.43	31.7	---	259	1,401	45,611	Not Recommended
2-99	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
1-241	Insulation for walls	.54	25.4	---	110	595	15,503	Not Recommended
2-241	Insulation for roof	.77	18	---	72	390	7,194	Not Recommended
3-241	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
4-241	Energy efficient ballasts	.41	25.6	.24	---	4.14	106	Not Recommended
1-247	Insulation for walls	1.44	7.2	12.1	---	211	1,560	Recommended
2-247	Energy management and control system	2.21	3.79	---	See Section IV	---	---	Recommended
1-1024	Energy management and control systems	2.21	3.79	---	See Section IV	---	---	Recommended

**ENERGY CONSERVATION OPPORTUNITY
PRIORITY LISTING
AND
NARRATIVE DESCRIPTIONS**

PRIORITY LISTING

ECO IN ORDER OF SIR

ECO OR GROUPING PRIORITY NO.	ECO NAME AND/OR NUMBER	SIR	ESTIMATED		ANNUAL		SAVINGS	COST SAVINGS \$	TOTAL INVESTMENT \$
			ELECTRICITY MBTU	STEAM MBTU	FUEL OIL MBTU				
1	Cargo door strip curtains (grouping)	17.17	---	25458	---	83190	57260		
2	Removal of existing fluorescent fixtures (17-1A)	9.12	142	---	---	2472	3000		
3	Heat recovery at plating rinse water (5-1A)	8.27	---	4924	---	16089	22982		
4	Ventilation heat reclaim at large exhaust sys- tems (3-1A)	5.37	---	39589	---	129365	279443		
5	Removal of electric and replacement with steam coils (1-ASRS)	3.21	150	-250	---	1788	5643		
6	Repair or replacement of weather- stripping (grouping)	3.20	---	6475	---	21159	78139		

PRIORITY LISTING

ECO IN ORDER OF SIR

ECO OR GROUPING PRIORITY NO.	ECO NAME AND/OR NUMBER	SIR	ESTIMATED		ANNUAL		SAVINGS FUEL OIL MBTU	COST SAVINGS \$	TOTAL INVESTMENT \$
			ELECTRICITY MBTU	STEAM MBTU					
7	Air compress- or heat recovery sys- tem (16-1A)	2.63	---	719	---	---	2349	10568	
8	Energy monitoring and control system	2.21	8804	50037	348	---	318625	1337984	
9	Replacement of heating boiler (4-24)	1.96	---	---	368	---	1991	14364	
10	Incandescent lighting re- placements (grouping)	1.92	14677	---	---	---	255357	1814998	
11	Heat recovery for main air compressors (3-9)	1.77	---	968	---	---	3162	21136	
12	Heat recovery for steam clean area (2-9)	1.67	-2.64	497	---	---	1577	11183	

PRIORITY LISTING

ECO IN ORDER OF SIR

ECO OR GROUPING PRIORITY NO.	ECO NAME AND/OR NUMBER	SIR	ESTIMATED			ANNUAL		SAVINGS FUEL OIL MBTU	COST SAVINGS \$	TOTAL INVESTMENT \$
			ELECTRICITY MBTU	STEAM MBTU						
13	Addition of heat destrat- ification fans Bays #5 & #6 (5-4)	1.50	.75	379				---	1250	9850
14	Insulation for walls (1-247)	1.44	12.1	---				---	211	1560
15	Additional insulation for roof (2-24)	1.41	3.04	---				99	589	5748
16	Modification of dust collection system (3-18)	1.35	---	106				---	347	3035
17	New combustion controls (2-22)	1.31	---	11397				---	37267	343710
18	Replace over- head door (10-5)	1.01	---	107				---	350	4104
			23,786.25	140,406				815	877,138	

165,007

PRIORITY LISTING

ECO IN ORDER OF TOBYHANNA PREFERENCE

USING AGENCY PRIORITY NO.	ECO NAME AND/OR NUMBER	SIR	ESTIMATED		ANNUAL		SAVINGS		TOTAL INVESTMENT \$
			ELECTRICITY MBTU	STEAM MBTU	FUEL OIL MBTU	COST SAVINGS \$			
1	Incandescent lighting re- placements (grouping)	1.92	14677	---	---	---	255357	1814998	
2	Repair or replacement of weather- stripping (grouping)	3.20	---	6475	---	---	21159	78139	
3	Cargo door strip curtains (grouping)	17.17	---	25458	---	---	83190	57260	
4	Energy monitoring and control system	2.21	8804	50037	348	---	318625	1337984	
5	Ventilation heat reclaim at large exhaust sys- tems (3-1A)	5.37	---	39589	---	---	129365	279443	
6	Heat recovery at plating rinse water (5-1A)	8.27	---	4924	---	---	16089	22982	
7	Removal of existing fluorescent fixtures (17-1A)	9.12	142	---	---	---	2472	3000	

PRIORITY LISTING

ECO IN ORDER OF TOBYHANNA PREFERENCE

USING AGENCY PRIORITY NO.	ECO NAME AND/OR NUMBER	SIR	ESTIMATED		ANNUAL		SAVINGS	COST SAVINGS \$	TOTAL INVESTMENT \$
			ELECTRICITY MBTU	STEAM MBTU	FUEL OIL MBTU				
8	Removal of electric and replacement with steam coils (1-ASRS)	3.21	150	-250	---	1788	5643		
9	New combustion controls (2-22)	1.31	---	11397	---	37267	343710		
10	Addition of heat destrat- ification fans Bays #5 & #6 (5-4)	1.50	.75	379	---	1250	9850		
11	Heat recovery for steam clean area (2-9)	1.67	-2.64	497	---	1577	11183		
12	Heat recovery for main air compressors (3-9)	1.77	---	968	---	3162	21136		
13	Modification of dust collection system (3-18)	1.35	---	106	---	347	3035		
14	Replacement of heating boiler (4-24)	1.96	---	---	368	1991	14364		

PRIORITY LISTING

ECO IN ORDER OF TOBYHANNA PREFERENCE

USING AGENCY PRIORITY NO.	ECO NAME AND/OR NUMBER	SIR	ESTIMATED		ANNUAL		SAVINGS		TOTAL INVESTMENT \$
			ELECTRICITY MBTU	STEAM MBTU	FUEL OIL MBTU	COST SAVINGS \$			
15	Air compress- or heat recovery sys- tem (16-1A)	2.63	---	719	---	2349	10568		
16	Replace over- head door (10-5)	1.01	---	107	---	350	4104		
17	Additional insulation for roof (2-24)	1.41	3.04	---	99	589	5748		
18	Insulation for walls (1-247)	1.44	12.1	---	---	211	1560		

ENERGY CONSERVATION OPPORTUNITY DESCRIPTIONS

PRIORITY NO. 1

ECO - GROUPING

CARGO DOOR STRIP CURTAINS

Overhead doors which must be left in an open position for extended periods should be fitted with cargo door strip curtains to reduce the volume of infiltration air which results in excessive use of steam heat. Cargo door strip curtains are effective devices in controlling high volume infiltration.

Overhead doors, when open, allow excessive infiltration at the rate of 4 air changes per hour. Provision of cargo strip curtains will reduce the infiltration rate to 1.0 air changes per hour.

Cargo door strip curtains are proposed to be provided for buildings 1B, 1C, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 41 and 55. Forty-three (43) doors with a total overhead door area of 6,566 square feet are proposed to be fitted with cargo door strip curtains.

PRIORITY NO. 2

ECO NO. 17-1A

REMOVAL OF EXISTING FLUORESCENT FIXTURES

In areas where new high pressure sodium lights have been installed, some fluorescent fixtures are mounted at the same height and do little for illumination. It is recommended that the fluorescent fixtures be removed. Fluorescent fixtures which are used for task lighting, which are typically mounted about 8'-10" a.f.f. should remain.

PRIORITY NO. 3

ECO NO. 5-1A

HEAT RECOVERY AT PLATING RINSE WATER

Recovery of heat from the plating rinse water can be accomplished with heat exchangers for heating make-up water for plating processes. A transfer efficiency of 70% can be expected through the heat exchanger. According to plating personnel at TOAD, rinse water temperature is approximately 200 degrees F and flow at approximately 2,000 gallons per hour. Average inlet water temperature is 55 degrees F. Operation of the plating area is 5 days per week, 8 hours for one day and 12 hours per day for 4 days for total hours of 2,912/year. All components which contact rinse water must be constructed with or be coated with a corrosion resistant material.

PRIORITY NO. 4

ECO NO. 3-1A

VENTILATION HEAT RECLAIM AT LARGE EXHAUST SYSTEMS

Large volume exhaust equipment located at the sandblast area, welding area, paint spray area, plating area and the printed circuit area are considered to be high energy users due to the large quantities of make-up air required. This ECO examines the use of a heat reclaim system to be utilized at each individual area to recover heat from the exhaust air. Air filtration systems are required for the sandblast, welding, and paint spray areas.

PRIORITY NO. 5

ECO NO. 1-ASRS

REMOVAL OF ELECTRIC AND REPLACEMENT WITH STEAM COILS

The existing electric heating coils located in the ductwork serving the mezzanine office level area are proposed to be replaced with steam heating coils. Electrical coils presently have a capacity of 47.2 KW. Actual load for space heating is 26.6 KW. Replacement of electric coils with steam coils will result in an annual savings of \$1,518. Installation costs are estimated to be \$5,500.

PRIORITY NO. 6

ECO - GROUPING

REPAIR OR REPLACEMENT OF WEATHERSTRIPPING

Weatherstripping on existing personnel doors and overhead doors is non-existent, damaged, or in very poor condition.

Weatherstripping at doors will result in a substantial reduction of infiltration into the building, thus providing substantial energy savings to the depot.

Weatherstripping of personnel and overhead doors is proposed for Buildings 1A, 1B, 1C, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 18 and 21. Two hundred fifty three (253) personnel doors with a total of 5,060 lineal feet of door weatherstripping and one hundred two (102) overhead doors with 4,930 lineal feet of door weatherstripping are required to be sealed with the appropriate type of weatherproofing.

PRIORITY NO. 7

ECO NO. 16-1A

AIR COMPRESSOR HEAT RECOVERY SYSTEM

The three large air compressors located in the basement of Building 1A presently utilize a roof-mounted cooling system to dissipate the heat generated by the compressors to the outdoors.

There are two 150 horsepower Chicago Pneumatic single screw compressors and a single 150 horsepower Sullair screw compressor located in the space. A rooftop cooler consists of a Young Radiator Co. cooling coil with a 10 horsepower cooling fan.

The energy recovery system investigated here utilized a 7000 cfm make-up air unit mounted below the roof with a heating coil and extension of the existing piping system and two 3-way automatic control valves to control the operation of the system.

PRIORITY NO. 8

ECO - GROUPING

ENERGY MONITORING AND CONTROL SYSTEM

The EMCS shall include all of the 47 buildings which were investigated in this study. The system will employ a central communications controller, central processing unit, modems, field interface devices, multiplexers, data terminal cabinets, control and monitoring transducers, printers, and all other appurtenances necessary to completely monitor the buildings and provide control throughout the facility.

The proposed recommended systems will be an electronic state-of-the-art system to monitor, control, and process information concerning building occupancy, environmental

conditions, utility usage, lighting, production equipment operation, temperature, setback, and other energy related categories.

The central processing unit and central communications controller should be located in the Facilities Engineering Office, Building No. 18, along with all the peripheral equipment. An additional alarm terminal with a printer should be located in the Security Office Building No. 20. The systems throughout each building will be individually controlled and/or monitored by the use of digital and analog devices and instrumentation. Control panels will be provided to accept up to 16 points of processing equipment along with a modem for information transfer to the central processing unit. The system will utilize fiber optic cable to communicate between buildings to the main terminal. Wiring within each building shall be accomplished by the use of a twisted pair of wires encased in a coaxial cable to prevent stray signals to the system and noise to any electronic communications system or 400 cycle test system in the buildings.

The Energy Monitoring and Control System was considered to have the following features, but modified to suit each individual building and/or location throughout the industrial facility:

- A. Scheduled Start/Stop Control
- B. Outside Air Limit Shutoff and Monitoring
- C. Ventilation and Recirculation
- D. Economizer
- E. Space Temperature Night Setback
- F. Boiler Monitoring
- G. Lighting

Control

- H. Run Time Recording
- I. Safety Alarms
- J. Space Temperature Control and Monitoring
- K. Process Temperature Monitoring and Control
- L. Steam Monitoring and Control
- M. Heating Equipment Monitoring and Control
- N. Machine Monitoring
- O. Production and Process Monitoring
- P. Building Power Consumption Monitoring

PRIORITY NO. 9

ECO NO. 4-24

REPLACEMENT OF HEATING BOILER

The existing heating boiler which supplied steam to the sewage treatment plant complex is an International Boiler Company Model 79, Type DD, originally installed in 1952, designed for anthracite coal operation. The boiler has since been converted to burn No. 2 fuel oil with a pressurized firebox type burner.

Due to the age of the boiler and it's inherent lack of efficiency, we recommend replacement of this unit.

PRIORITY NO. 10

ECO - GROUPING

INCANDESCENT LIGHTING REPLACEMENT

Incandescent light fixtures located in Buildings 1B, 2, 3, 4, 5, 6, 7, 8 and 23 are considered to be high energy users due to their poor luminous efficacy (lamp lumens/lamp watts). These ECO's examine the use of high pressure sodium light fixtures in lieu of incandescent light fixtures for illumination.

PRIORITY NO. 11

ECO NO. 3-9

HEAT RECOVERY AT MAIN AIR COMPRESSOR

Heat recovery can be accomplished by piping the existing compressor coolings fluids through air recirculation units within the building rather than through the existing fluid coolers located outdoors. Controls and control valves will regulate operation of either indoor and outdoor units dependent upon outdoor and indoor temperatures. Indoor units shall be suspended air handling units to recirculate 100% space air and shall be equipped with reclaim heating coils, fans, filters, and controls.

Air compressors at Building No. 9 are two Chicago pneumatic screw compressors each operating with 100 horsepower. Operation is approximately 7hours/day at 70% estimated full load.

Heating Period = September 15 == > May 1, 5 days/week

= 160 days (this neglects varying overtime
periods including weekends)

PRIORITY NO. 12

ECO NO. 2-9

HEAT RECOVERY SYSTEM

The steam cleaning has been provided with an exhaust air system and a make-up air system to provide adequate ventilation for the space.

The system handles 12,000 cfm and at the present time has no heat recovery system.

Approximately 75% of the heat of the exhausted air can be recovered and transferred to the make-up air system by utilizing a glycol/water run around loop and reclaim coils in the exhaust and make-up air ductwork.

PRIORITY NO. 13

ECO NO. 5-4

ADDITION OF HEAT DESTRATIFICATION FANS FOR BAYS #5 AND #6

Bays #5 and #6 do not have destratification fans. This condition allows the space temperatures to stratify. The occupied zone temperature is maintained at 65 degrees F while the air temperature immediately below the roof, 25 feet above the floor, is estimated to be 90 degrees F. Installation of destratification fans will decrease the air temperature below the roof to 70 degrees F.

PRIORITY NO. 14

ECO NO. 1-247

INSULATION FOR WALLS

The existing wall construction of Building 247 with 8" CMU has a "U" value of 0.39. The addition of an exterior insulation system of 2" rigid insulation with a synthetic (Dryvit) finish will improve wall thermal resistance and change "U" value to 0.08.

PRIORITY NO. 15

ECO NO. 2-24

ADDITIONAL INSULATION FOR ROOF

The existing roof system of Building 24 with the composite system of concrete deck, 1" roof insulation and built-up roofing should be improved to reduce heating energy loss. The present roof "U" value is 0.16. An improved roof insulation system can be accomplished by adhering insulating to the underside of the roof to improve roof "U" value to 0.05.

PRIORITY NO. 16

ECO NO. 3-18

MODIFICATION OF DUST COLLECTION SYSTEM

The existing exterior dust collector from the carpentry shop exhausts room air and discharges it to the outdoors. Make-up air infiltrates from the outdoors and consequently

must be heated. This ECO proposes to return the air to the space to reduce heating by eliminating the make-up air. The collector must be ducted back to the building and a final filter added in the building. The entire exterior collector and exterior duct system must be installed.

PRIORITY NO. 17

ECO NO. 2-22

NEW COMBUSTION CONTROLS

Existing combustion controls which function to control the operation of the boilers in the central boiler plant, Building No. 22, are in need of replacement. Removal of the controls and provision of new combustion controls will result in an improvement of 2% in overall plant efficiency and save the Depot \$37,267 annually.

PRIORITY NO. 18

ECO NO. 10-5

REPLACE OVERHEAD DOOR

The existing vertical lift 12'-0" x 14'-0" at the South end of Building No. 5 is in poor condition and must be replaced.

PROJECT FUNDING

PROJECTS QUALIFYING FOR FUNDING

PROJECT PRIORITY NO.	DESCRIPTION	COST	PAYBACK	FUNDING TYPE
1	Cargo door strip curtains	57,260	.67	QRIP
2	Removal of exist- ing fluorescent fixtures	3,000	1.14	LOW COST
3	Heat recovery at plating rinse water	22,982	1.39	QRIP
4	Ventilation heat reclaim at large exhaust systems	279,443	1.58	OSD PIF
5	Removal of electric and replacement with steam coils	5,643	3.08	LOW COST
6	Repair or replacement of weatherstripping	78,139	3.6	LOW COST
7	Air compressor heat recovery system	10,568	4.4	LOW COST
8	Energy monitoring and control system	1,486,649	4.32	ECIP
9	Replacement of heating boiler	14,364	7.0	LOW COST
10	Incandescent lighting replace- ments	1,814,998	6.93	ECIP
11	Heat recovery for main air compressors	21,136	6.5	LOW COST

PROJECTS QUALIFYING FOR FUNDING
(continued)

<u>PROJECT PRIORITY NO.</u>	<u>DESCRIPTION</u>	<u>COST</u>	<u>PAYBACK</u>	<u>FUNDING TYPE</u>
12	Heat recovery for steam clean area	11,183	6.53	LOW COST
13	Addition of heat destratification fans Bays #5 & #6	9,850	7.8	LOW COST
14	Insulation for walls	1,560	7.2	LOW COST
15	Additional insulation for roof	5,748	10.5	LOW COST
16	Modification of dust collection system	3,035	8.5	LOW COST
17	New combustion controls	343,710	9.0	ECIP
18	Replace overhead door	4,104	11.4	LOW COST

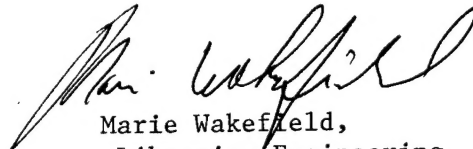


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